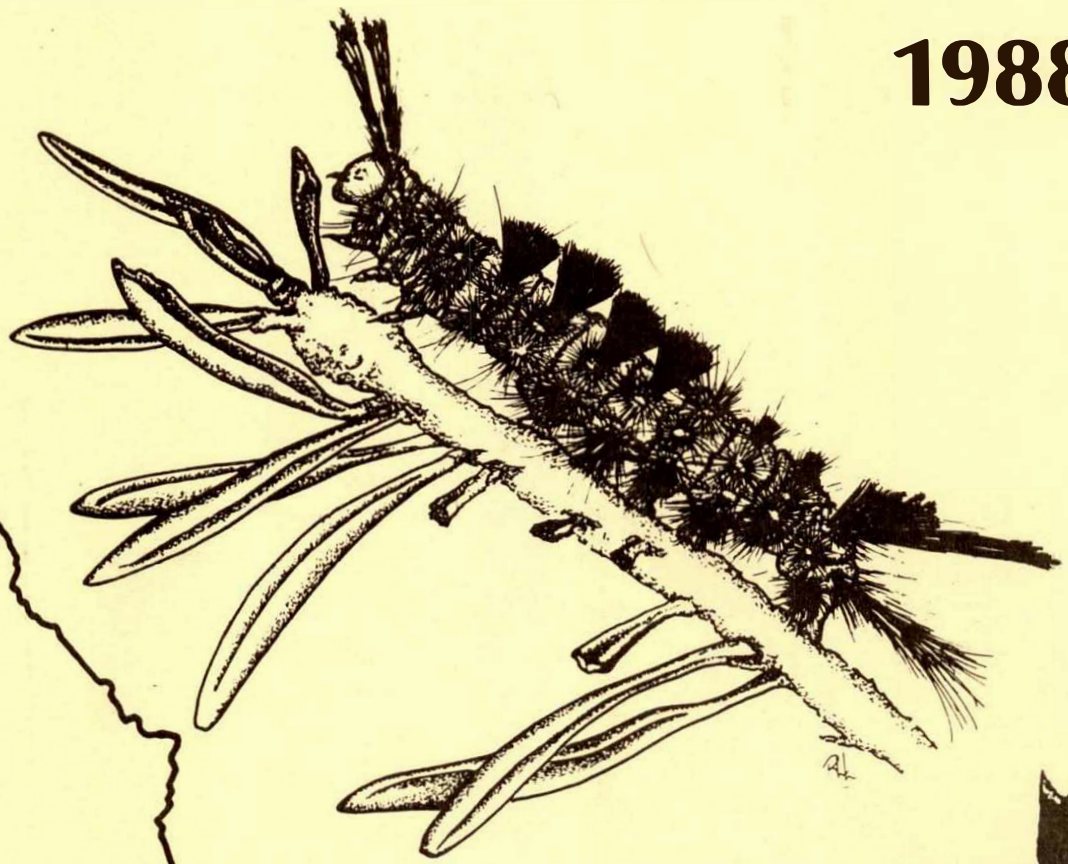
IDAHO FOREST PEST CONDITIONS & PROGRAM SUMMARY

1988



IDAHO DEPARTMENT OF LANDS

USDA FOREST SERVICE
NORTHERN AND INTERMOUNTAIN
REGIONS

Report No. 88-1

IDAHO FOREST PEST CONDITIONS

AND

PROGRAM SUMMARY

1988

by

R. L. James
USDA Forest Service
Coeur d'Alene, Idaho

S. Zimmer
USDA Forest Service
Missoula, Montana

J. W. Schwandt, R. L. Livingston, and D. P. Beckman
Idaho Department of Lands
Coeur d'Alene, Idaho

J. T. Hoffman, K. A. Knapp, and J. Weatherby
USDA Forest Service
Intermountain Region
Boise, Idaho

Report No. 89-1

July 1989

TABLE OF CONTENTS

INTRODUCTION

This report summarizes major insect and disease damage on forested lands of all ownerships within the State of Idaho for 1988. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by pest management personnel within the USDA Forest Service and Idaho Department of Lands. This report also describes several aspects of the pest management program for each of the agencies.

Losses outlined in tables are only estimates. Likewise, maps outlining areas of major insect infestations provide general locations of problems.

CONDITIONS IN BRIEF

Insects

Although mountain pine beetle activity exhibited a slow decline in northern Idaho, activity of other bark beetles mostly increased. These included Douglas-fir, pine engraver, western pine, and fir engraver beetles. Increases were probably in response to persistent drought conditions that occurred throughout the State. Western spruce budworm damage increased on the Salmon River Ranger District (RD), Nez Perce National Forest (NF), but generally decreased elsewhere. The gypsy moth populations in Coeur d'Alene and Sandpoint persisted at approximately static levels. Ground sprays were conducted in both cities for control of early instar larvae. Pheromone surveys did not locate the gypsy moth in other cities.

Direct control efforts using insecticides were successful in reducing damage of cranberry girdler moth at the USDA Forest Service Nursery in Coeur d'Alene and by cone and seed insects at several locations.

Diseases

Root diseases, white pine blister rust, and several nursery diseases continued to be the most important disease problems in northern Idaho and dwarf mistletoes were most damaging in the southern portion of the State. Root disease losses continued to increase; however, several projects designed to evaluate effects of different silvicultural treatments were continued to determine which treatments would be most effective in stands with concentrated root diseases. The root disease model (linked to the Prognosis growth model) was in its final stages of testing; validation will be necessary before the model is available for widespread use. Increased root disease losses may have been associated with continued drought conditions that prevailed over much of the State.

Efforts to reduce impact of white pine blister rust continued to center around resistance development using improved seed orchard stock and application of hazard rating schemes on sites of current or potential damage from this disease. Other options investigated included pruning and excising cankers in high value stands.

Nursery diseases associated with *Fusarium*, *Pythium*, and *Botrytis* continued to cause important losses in bareroot and container seedling nurseries in northern Idaho. Evaluations of new control techniques continued.

Dwarf mistletoe control using properly designed silvicultural treatments continued to be implemented within many forest stands, particularly in southern Idaho.

INSECTS

BARK BEETLES

Mountain Pine Beetle

Mountain pine beetle activity in northern Idaho continued a slow decline in 1988 (Table 1). Small, scattered groups of lodgepole and ponderosa pine faders were reported in many areas but no serious or building infestations are believed to exist. Less than 12,500 infested acres were reported this year with just over 22,000 faded trees observed. In contrast, 41,000 faders were observed on 14,400 acres in 1987.

The infestation near Dennis Mountain, West Fork RD, Bitterroot NF, began to decline even though susceptible lodgepole pine stands remain in the area. Less than 1,600 acres were infested this year, while about 2,800 acres were infested during each of the previous 2 years.

On the Nez Perce NF, infested acres of lodgepole pine were about one-third of those observed in 1987. The number of infested acres near Red River and Elk City was down from 6,400 in 1987 to about 2,300 in 1988. Small groups of faders were noted on private, State and BLM lands in the vicinity of Elk City. As lodgepole pine stands are brought under management, susceptible and infested acreage should decrease.

In the Craig Mountains near Soldiers Meadow Reservoir, infested lodgepole and ponderosa pine stands were less severely impacted this year than in 1987. Though an increase in infested acres was reported, infestation intensity declined markedly. The number of reported faders declined from 18,000 to just over 8,400 in 1988. The infestation is expected to continue to decline.

The infestation on the Idaho Panhandle NFs is characterized as small, scattered groups of lodgepole and ponderosa pine mortality. Most notable groups of lodgepole pine faders were to the northwest of Lookout Pass on the Wallace RD and in the southeast portion of Bonners Ferry RD. The infestation in the Boulder Creek drainage has increased slightly to about 950 acres.

Scattered mortality throughout host types was also recorded on the Boise, Caribou, Payette, and Targhee NFs. Increasing beetle activity also occurred on the Challis, Salmon and Sawtooth NFs.

On the Challis NF, lodgepole pine mortality increased to 15,700 trees in 1988 from about 4,750 reported in 1987. Heaviest infestations were recorded in the Yankee Fork and Squaw Creek portions of the Salmon River drainage.

Tree mortality increased on the Salmon NF from 3,750 observed in 1987 to about 7,000. Most of the mortality was located adjacent to the Long Tom fire along the upper portion of Long Tom and Beartrap Ridges.

Beetle-caused mortality on the Sawtooth NF was concentrated throughout the Big Wood River drainage from Ketchum to Galena Summit, and throughout Deer Creek and Warm Springs Creek

drainages. Lodgepole pine mortality increased from 11,600 trees in 1987 to 13,700 in 1988. Activity also increased substantially in the Sawtooth Valley killing about 6,400 trees in 1988.

Douglas-fir Beetle

The Douglas-fir beetle outbreak continued during 1988 (Table 1). Approximately 73,600 trees were killed on about 26,500 acres in north Idaho, or an average of 2.8 trees killed per acre. Trees killed in 1988 increased 63 percent while the affected area increased by about 74 percent. Though significant, these increases were relatively small compared to the explosive increase experienced in 1987. Areas sustaining the most extensive damage included private lands near the Idaho Panhandle NFs, the Red River, Selway, and Elk City RDs of the Nez Perce NF and associated private lands, the Canyon RD of the Clearwater NF, the Craig Mountains, Maggie Creek, and the West St. Joe State and BLM lands. Parent/offspring ratios indicated that populations may continue to increase on the Kaniksu portion of the Idaho Panhandle NFs and the Nez Perce NF in 1989. Populations appeared to be static or declining on portions of the Idaho Panhandle NFs and the Clearwater NF.

The Idaho Department of Lands initiated aggressive management of Douglas-fir beetle populations in 1988. Near Pend Oreille Lake they accelerated harvest of green trees in high risk stands, and salvaged dead and infested trees. They also baited proposed logging road rights-of-way with aggregative pheromones. Baits were used to attrack beetles to trees which would be removed during road building. All baited trees and many surrounding trees were attacked, but no attacked trees were observed beyond the road rights-of-way.

Southern Idaho experienced a nearly six-fold increase in Douglas-fir beetle activity during 1988 with an estimated 87,600 trees killed. Most beetle activity was associated with old fires. The beetle population built up in scorched trees from which they moved into adjacent, unburned stands. The Boise and Payette NFs were most severely affected.

Spruce Beetle

Spruce beetle activity (Table 1) increased dramatically on the Payette NF in southern Idaho where about 45,000 recently-killed trees were observed in 1988. This compared to about 16,000 trees in 1987. This outbreak continued to expand in many mature spruce stands in the area. It is expected that this outbreak will continue until the host is depleted. Salvage and trap tree programs are being continued in accessible commercial areas. Accelerated harvest of susceptible stands is also planned.

Spruce beetle activity decreased on the Boise NF with only 250 recently-killed trees observed in 1988 compared wtih 650 in 1987. Spruce beetle activity in northern Idaho was minimal in 1988.

Pine Engraver and Western Pine Beetle

Infestations of typically "secondary" bark beetles increased as a result of continued extremely dry conditions during 1988 (Table 1). More than 3,700 acres, usually located in small, scattered groups of less than 10 acres, were infested with the pine engraver. An estimated 12,000 trees were killed. Most infested areas occurred on or near the Idaho Panhandle NFs, particularly on adjacent, low elevation private lands. Greater mortality was also observed on the Nez Perce Indian Reservation, Mica State Forest, and in the Craig Mountains south of Lewiston.

Increases in western pine beetle activity probably occurred in some areas, although increases in infested acres and trees killed were not detected from aerial surveys. Some second growth ponderosa pine mortality, initially attributed to pine engraver, was actually killed by western pine beetle. More faders were noted in scattered groups on the Idaho Panhandle NFs, Mica State Forest, Pend Oreille State Forest, and in the Craig Mountains. An estimated 2,000 trees on about 1,500 acres were killed by the western pine beetle.

In southern Idaho, western pine beetle and pine engraver beetle killed about 32,250 trees on the Boise NF. Most mortality was concentrated in second growth ponderosa pine stands in the Idaho City and Boise Basin areas. Mortality was also noted throughout the Anderson Creek burn in the South Fork of the Payette River drainage.

Mortality on the Payette NF due to these beetles increased substantially throughout the Weiser River drainage, particularly in association with the French Creek burn and along the Little Salmon River. Tree mortality increased to 8,850 this year.

Fir Engraver

Fir engraver beetles also took advantage of drought-weakened hosts in 1988 (Table 1). Mortality in grand fir stands attributable to fir engraver was recorded on only about 2,000 acres in 1987. However, infested acreage increased markedly in 1988 to more than 33,600. It was estimated that nearly 43,000 trees were killed in 1988. The fir engraver will probably continue to kill drought- and root disease-stressed trees as long as these conditions remain. Most of the infested acreage was on private lands within and near the Idaho Panhandle NFs.

Table 1.–Idaho Statewide summary; annual bark beetle mortality by reporting area: north Idaho.

		Mountain pine beetle estimated mortality			Douglas-fir beetle estimated mortality			Spruce beetle estimated mortality			Pine engraver estimated mortality			Fir engraver estimated mortality		
Area	Year	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume
Bitterroot NF	1988	1,591	2,817	253.3	840	1,628	569.8	1	6	2.4	0	0	0.0	0	0	0.0
	1987	14	146	11.7	13	124	43.4	1	5	2.0	0	0	0.0	0	0	0.0
Cataldo	1988	385	1,677	149.9	479	1,863	652.1	0	0	0.0	0	0	0.0	86	65	13.0
	1987	501	1,507	135.6	100	145	50.8	0	0	0.0	0	0	0.0	35	50	10.0
Clearwater NF	1988	1	2	0.8	5,248	13,046	4,566.1	0	0	0.0	18	175	4.4	5,834	6,875	1,375.0
	1987	5	35	6.3	3,787	10,286	3,600.1	0	0	0.0	54	170	4.3	199	735	147.0
CPTPA	1988	1	10	0.8	2,215	5,162	1,806.7	0	0	0.0	196	890	22.3	1,309	3,934	786.8
	1987	4	32	12.8	673	3,249	1,137.2	0	0	0.0	4	35	0.9	285	1,224	244.8
Craig Mtns.	1988	6,061	7,082	635.4	10	115	40.3	0	0	0.0	583	2,290	57.3	417	1,533	306.6
	1987	3,203	18,878	1,694.4	35	132	46.2	0	0	0.0	103	325	8.1	8	23	4.6
IPNF's	1988	776	2,713	254.2	10,231	37,265	13,042.8	0	0	0.0	25	55	1.4	542	1,305	261.0
	1987	951	2,281	270.4	7,694	13,843	4,845.1	0	0	0.0	10	95	2.4	294	860	172.0
Kendrick	1988	0	0	0.0	16	160	56.0	0	0	0.0	80	800	20.0	13,467	12,800	2,560.0
	1987	0	0	0.0	3	25	8.8	0	0	0.0	158	820	20.5	161	680	136.0
Maggie Creek	1988	1	5	0.4	25	184	64.4	0	0	0.0	16	125	3.1	122	468	93.6
	1987	1	6	2.4	0	0	0.0	0	0	0.0	0	0	0.0	5	40	8.0
Mica	1988	350	404	36.1	157	1,264	442.4	0	0	0.0	1,994	5,310	132.8	3,837	7,910	1,582.0
	1987	0	0	0.0	2,352	14,105	4,936.8	0	0	0.0	306	2,817	70.4	523	1,981	396.2
Nez Perce NF	1988	2,895	7,100	633.6	360	1,799	629.7	0	0	0.0	744	2,255	56.4	674	2,011	402.2
	1987	7,478	15,834	1,425.2	92	419	146.7	0	0	0.0	20	150	3.8	3	22	4.4
Pend Oreille	1988	112	125	10.8	575	1,536	537.6	0	0	0.0	360	625	15.6	1,352	1,541	308.2
	1987	0	0	0.0	60	560	196.0	0	0	0.0	378	3,645	91.1	112	986	197.2
Priest Lake	1988	2	10	0.9	6,044	8,835	3,092.3	0	0	0.0	9	60	1.5	4	35	7.0
	1987	0	0	0.0	134	1,325	463.8	0	0	0.0	16	160	4.0	54	185	37.0

Table 1.–Idaho Statewide summary; annual bark beetle mortality by reporting area: north Idaho, continued.

		Mountain pine beetle estimated mortality			Douglas-fir beetle estimated mortality			Spruce beetle estimated mortality			Pine engraver estimated mortality			Fir engraver estimated mortality		
Area	Year	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume	Acres infested	Trees	MBM volume
W. St. Joe	1988	0	0	0.0	292	719	251.7	0	0	0.0	515	1,385	34.6	6,035	5,885	1,177.0
	1987	1	10	4.0	282	965	337.8	15	100	40.0	535	2,045	51.5	708	2,877	575.4
No. Idaho Totals	1988	12,175	21,945	1,975.3	26,492	73,576	25,751.6	1	6	2.4	4,540	13,970	349.3	33,679	44,362	8,872.4
	1987	12,158	38,729	3,562.8	15,225	45,178	15,812.3	16	105	42.0	1,584	10,262	256.6	2,387	9,663	1,932.6
Boise	1988	3,568	4,443	260.6	32,836	33,759	4,793.0	155	254	121.4	46,511	32,254	322.5	0	0	0.0
	1987	3,494	4,418	289.2	3,373	5,027	713.8	607	669	319.8	5,578	7,907	79.1	0	0	0.0
Caribou	1988	0	0	0.0	17,128	20,662	2,934.0	0	0	0.0	0	0	0.0	0	0	0.0
	1987	130	182	11.6	1,148	1,262	179.2	0	0	0.0	0	0	0.0	0	0	0.0
Challis	1988	11,523	15,707	1,005.0	138	176	25.0	0	0	0.0	0	0	0.0	0	0	0.0
	1987	15,759	4,730	302.7	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Payette	1988	316	517	25.9	8,669	18,857	2,677.0	36,364	44,756	2,193.4	7,426	8,829	88.2	0	0	0.0
	1987	931	1,297	82.4	1,524	1,855	263.4	13,002	15,873	7,875.3	1,282	1,364	13.6	0	0	0.0
Salmon	1988	4,885	7,020	449.3	818	845	120.0	0	0	0.0	1,858	1,623	16.2	0	0	0.0
	1987	12,759	3,754	240.3	55	79	11.2	0	0	0.0	663	602	6.0	0	0	0.0
Sawtooth	1988	8,519	13,727	879.2	3,343	4,687	665.6	0	0	0.0	0	0	0.0	0	0	0.0
	1987	9,200	11,609	743.0	1,016	1,200	170.4	0	0	0.0	55	53	0.5	0	0	0.0
Targhee	1988	262	335	21.4	2,824	3,114	442.2	0	0	0.0	0	0	0.0	0	0	0.0
	1987	350	735	47.0	1,227	1,220	173.2	0	0	0.0	0	0	0.0	0	0	0.0
S. Idaho Totals	1988	29,073	41,759	2,642.4	65,756	82,100	11,656.7	36.519	45,010	21,514.8	55,795	42,706	427.0	0	0	0.0
	1987	42,623	26,815	1,716.2	8,343	10,643	1,511.3	13,609	16,542	7,907.1	7,578	9,926	99.3	0	0	0.0
State Totals	1988	41,248	63,704	4,616.6	92,248	155,676	37,408.3	36,520	45,016	21,517.2	60,335	56,676	776.2	33,679	44,362	8,872.4
	1987	54,781	65,544	5,278.9	23,568	55,821	17,323.6	13,625	16,647	7,949.1	9,162	20,188	355.8	2,387	9,663	1,932.6

DEFOLIATORS

Western Spruce Budworm

The western spruce budworm outbreak on the Salmon River RD, Nez Perce NF, increased by about 4,200 acres. Total infested area covered 18,700 acres (Table 2). Most aerially observed defoliation was classified as "light". The number of egg masses collected in this area declined, indicating that the population and resulting defoliation will likely decline in 1989.

The budworm population on the Bitterroot NF, north of Magruder's Crossing on the Selway River and Deep Creek, apparently collapsed. No defoliation was detected during the 1988 aerial survery. However, detection of light defoliation may have been hampered by smoke from the many fires this past year.

In southern Idaho, the western spruce budworm populations fell to their lowest recorded level since the start of aerial detection in 1952. On the Boise, Challis, Sawtooth, and Targhee NFs, defoliation decreased dramatically. Infested acreage declined by about 831,600, and most defoliation was reported as light or moderate.

Larch Casebearer

The larch casebearer continued at very low levels throughout Idaho in 1988. Only small, isolated pockets of visible defoliation were found; the majority of these occurred southwest of Coeur d'Alene along the ridge formed by Mica Peak, Cable Peak, Round Mountain and Twin Peaks. A few scattered pockets of defoliation were also seen in the Clearwater River drainage.

Douglas-fir Tussock Moth

No aerially visible defoliation caused by the Douglas-fir tussock moth was observed in Idaho during 1988. In northern Idaho, pheromone survey trap counts were at the lowest levels since 1977-1980 when very few or no moths were caught (Table 3). However, Douglas-fir tussock moth defoliation has been seen on trees within the cities of Coeur d'Alene, St. Maries, and Kellogg. Trees at the USDA Forest Service Nursery in Coeur d'Alene were also affected.

In southern Idaho, decreasing or static populations were detected from pheromone traps on the Boise, Payette, and Sawtooth NFs. Populations increased at Colson and Lick Creeks on the Salmon NF, at Sharps Canton on State land, and at Dewey Peak and New York Summit in the Owyhee Mountains (Table 3).

Table 2.--Acres of western spruce budworm defoliation as determined by aerial surveys in 1987 and 1988.[1]

Forest and adjacent lands	Year	Light	Moderate	Heavy	Total	Change
Bitterroot	1987	40,960	8,070	280	49,310	--
	1988	0	0	0	0	- 49,310
Boise	1987	337,400	58,000	31,300	426,700	--
	1988	180	160	0	340	- 426,360
Caribou	1987	32,300	15,100	4,600	52,000	--
	1988	0	0	0	0	- 52,000
Challis	1987	16,900	4,000	0	20,900	--
	1988	4,000	870	1,370	6,240	- 14,660
Nez Perce	1987	11,030	3,380	0	14,410	--
	1988	10,570	6,260	1,850	18,680	4,270
Payette	1987	119,000	15,800	0	134,800	--
	1988	0	0	0	0	- 134,800
Salmon	1987	60	540	0	600	--
	1988	4,310	1,340	160	5,810	5,210
Sawtooth	1987	65,700	18,200	900	84,800	--
	1988	1,170	0	0	1,170	- 83,630
Targhee	1987	104,400	9,200	1,800	115,400	--
	1988	20,800	1,400	6,450	28,690	- 86,710
Total	1987	727,750	132,290	38,880	898,920	--
	1988	41,030	10,070	9,830	60,930	- 837,990

[1]Only portions of the National Forests of southern Idaho were flown. Actual acreage figures are probably higher.

Table 3.--Average Douglas-fir tussock moth pheromone trap catches in Idaho, 1980-1988.

Area	Number of sample plots	Means of average moth catch per 5 traps/sample plot								
		1980	1981	1982	1983	1984	1985	1986	1987	1988
STATE AND PRIVATE										
Sandpoint	2	0	0	.1	0	0	0	0	*	*
Coeur d'Alene	6 (4 in 88)	0	0	1.1	3.1	4.4	8.0	7.0	.2	0
Plummer-Moscow	15 (13 in 88)	0	.8	8.2	12.3	17.5	85.8	22.6	1.2	.01
Plummer-Moscow	18 (8 in 88)	*	*	2.5	3.3	7.0	43.2	15.2	.3	0
Plummer-Moscow	13 (4 in 88)	*	*	*	4.3	9.0	35.2	14.6	.5	0
Plummer-Moscow	1	*	*	*	*	36.43	68.4	42.8	1.0	0
Plummer-Moscow	2 (1 in 88)	*	*	*	*	*	76.0	49.7	3.8	0
Plummer-Moscow	3 (1 in 88)	*	*	*	*	*	*	80.5	9.0	.2
Craig Mountain	7	*	2.7	.5	.5	.6	.4	3.5	.1	0
Deary	15 (13 in 88)	*	*	*	*	*	*	*	2.2	.02
NEZ PERCE NF										
Selway RD	4 (1 in 85)	.2	1.2	.7	.1	.1	0	.1	0	0.5
Slate Creek RD	5 (3 in 85-88)	0	1.6	2.8	.6	1.4	.3	.9	0	0
Slate Creek RD	6	*	*	1.3	.3	0	*	*	*	*
Elk City RD	3	*	*	.3	.1	0	*	*	*	*
Red River RD	2	*	*	0	0	0	*	*	*	*
Clearwater Rd	3	0	0	0	0	0	*	*	*	*
Clearwater RD	4	*	*	.6	.6	.3	.3	*	*	*

Table 3.–Average Douglas-fir tussock moth pheromone trap catches in Idaho, 1890-1988, cont.

Area	Number of sample plots	Means of average moth catch per 5 traps/sample plot								
		1980	1981	1982	1983	1984	1985	1986	1987	1988
CLEARWATER NF										
Lochsa RD	5 (2 in 85-87)	*	3.6	.2	0	0	0	.3	0	0
Canyon RD	8 (5 in 85-87)	*	*	8.7	*	*	.09	1.7	0	*
Pierce RD	18 (5 in 85-87, 10 in 88)	*	*	.3	.1	.1	.6	4.0	.1	0.2
Potlatch RD	8	*	*	1.8	4.5	13.0	30.8	12.8	*	*
Powell RD	8	*	*	.3	.1	0	*	*	*	*
BOISE NF										
Cascade RD	2 (1 in 86 & 87)	*	.1	.3	20.0	0	1.0	1.2	.2	0.2
Mountain Home RD	2 (1 in 86 & 87)	*	*	.3	21.7	.4	0	1.2	1.4	0.6
PAYETTE NF										
Council RD	2 (5 in 86, 10 in 87)	*	*	43.3	38.2	6.7	5.1	21.2	7.4	1.9
McCall RD	1	*	0	.6	11.0	.5	*	*	*	*
Weiser RD	3 (5 in 86, 9 in 87)	*	*	43.3	42.1	8.1	4.1	15.2	5.2	0.7
SALMON NF										
Cobalt NF	2	*	*	0	2.6	0	*	*	*	*
North Fork RD	2	*	*	11.4	38.7	1.9	*	6.6	2.9	21.3

Table 3.--Average Douglas-fir tussock moth pheromone trap catches in Idaho, 1890-1988, cont.

Area	Number of sample plots	Means of average moth catch per 5 traps/sample plot								
		1980	1981	1982	1983	1984	1985	1986	1987	1988
SAWTOOTH NF										
Burley RD	1	*	*	*	*	.2	*	*	*	*
Fairfield RD	3 (2 in 86, 4 in 87)	*	1.6	5.2	20.3	6.3	0	19.7	13.3	3.3
Ketchum RD	1	*	*	2.6	14.8	.8	*	*	*	*
OTHER FEDERAL										
Owyhee Mountains	2 (4 in 86, 6 in 87)	27.8	55.8	*	*	10.8	.6	9.4	7.8	15.8
Sharps Canyon	1	*	19.4	16.2	41.2	1.3	5.2	22.6	8.4	36.4

* Indicates no traps were deployed.

Gypsy Moth

Detection of moths with pheromone traps in Sandpoint and Coeur d'Alene during 1987 prompted extensive egg mass surveys in these two cities during March-April, 1988. It was estimated that about 50 percent of the egg masses present were actually detected during these surveys. Control projects were instituted to reduce insect buildup; pesticides were applied from the ground during May 3-25, 1988 using Orthene® for most areas and Dipel® (*Bacillus thuringiensis*) for fruit trees. In Sandpoint, 68 trees on 19 properties were treated and in Coeur d'Alene, 23 trees on four properties were sprayed.

Pheromone-baited traps were deployed in 135 major cities and towns of Idaho during 1988. This survey was designed to provide background information on relative levels of gypsy moth throughout the state. Moths were found mostly in Coeur d'Alene and Sandpoint. In Coeur d'Alene 87 moths were caught at 54 sites; in Sandpoint, 334 moths were caught at 154 sites. One moth was caught in Kootenai, a small town about 3 miles NE of Sandpoint. Fall egg mass surveys conducted in Sandpoint and Coeur d'Alene indicated 32 and two new egg masses in each city, respectively. Plans are being made to continue control efforts for the gypsy moth in these two cities.

Western Pine Shoot Borer

Western pine shoot borer infestation levels were not determined at the Tensed and Lone Mountain ponderosa pine test plantations in 1988. However, populations were high enough to warrant ongoing control efforts. The shoot borer sex attracting pheromone was applied to these plantations via hand-tied "Luretape®" strips to retard mating. This effort has generally been successful in previous years. The shoot borer is a pest of varying degrees in most stands of young ponderosa pine, but the cost of pheromone control limits its use to only high value plantations.

Sugar Pine Tortrix and Pine Needle Sheathminer

Defoliation caused by the sugar pine tortrix and pine needle sheathminer decreased in 1988. Scattered defoliation of lodgepole and ponderosa pine persisted on the Boise, Payette, Sawtooth, and Targhee NFs.

Pine Butterfly

No defoliation resulting from feeding by pine butterfly was noted in Idaho this year. However, large numbers of adults were reported around Post Falls, Idaho. Elsewhere in the State, the outbreaks of a few years ago have collapsed and populations have returned to endemic levels.

MINOR INSECTS

Gouty Pitch Midge

The gouty pitch midge continued at fairly high levels in northern Idaho, although not as high as during 1987. Its range extended farther south to plantations in the area of Tensed.

Cranberry Girdler Moth

The Coeur d'Alene Nursery continued to monitor cranberry girdler moth populations using pheromone traps to attract male moths. Peak trap catch occurred the week of July 21, 2 weeks later than in 1987.

The highest number of moths trapped was 506 in 12 traps. Thirty-eight more moths were trapped during the same period last year. The total number of moths trapped this year was 2,289, 605 more than in 1987.

Treatment during 1988 consisted of two applications of diazinon and one application of Dursban® between July 22 and August 24. In 1987, three applications of diazinon and two of Dursban® were made between June 12 and August 26. Treatment results in 1988 were similar to those of 1987. Only two seedlings of 11,985 examined were damaged by this insect. Since treatment began, girdler moth damage has been reduced from nearly 10 percent of the bareroot Douglas-fir seedlings to less than 1 percent annually.

Balsam Woolly Adelgid

The known range of balsam woolly adelgid in northern Idaho expanded during 1988. New populations were found southeast of Pierce, and east of Lowell on Coolwater Ridge. Infested subalpine fir was found at elevations to 6,000 feet. Tree mortality occurred at these elevations, possibly from the combination of balsam woolly adelgid and root disease. The degree of infestation in these areas suggests that the adelgid has probably existed there for some time.

Balsam woolly adelgid has also been found on several grand fir adjacent to infested subalpine fir on the Palouse RD, Clearwater NF. Populations on grand fir ranged from very light to heavy; the insect occurred over the entire bole and branches of many trees. However, no grand fir mortality was observed. Permanent plots were established in infested grand fir stands to monitor future impact of the insect.

Cone and Seed Insects

Cone and seed insects remained an important management concern at cone producing western white pine seed orchards in Idaho. The insecticide Pydrin® was applied aerially to the Moscow White Pine Arboretum for control of the western conifer seed bug. Application was made in mid-July. About 800 bushels of cones were harvested from the Arboretum in 1988, and 1,000 bushels are predicted for 1989. There was some indication of increasing populations of cone worms and lodgepole pine cone borer. Hence, both a spring and summer Pydrin® treatment may be needed in 1989.

Two hundred eighty-nine bushels of seed-producing cones were harvested at the Sandpoint seed orchard in 1988. It was estimated that between 100 and 200 bushels of cones were lost to insects, primarily the ponderosa pine cone beetle.

The primary insect pest in the Coeur d'Alene seed orchard was once again the western conifer seed bug. A single treatment of the synthetic pyrethroid insecticide Pounce® was applied with ground spraying equipment to control this pest. Four hundered fifty-eight bushels of cones were collected in 1988; 600-800 bushels are expected in 1989.

Large populations of the western conifer seed bug throughout northern and southwestern Idaho have prompted complaints and concerns of rural property owners. The insect has become a major nuisance outside and inside homes.

Forest Tent Caterpillar

The forest tent caterpillar population declined in northern Idaho during 1988. Although there were some areas of defoliation, populations appeared to decrease.

Hemlock Sawfly

Hemlock sawfly populations near Priest Lake returned to endemic levels. No hemlock sawfly-caused defoliation was noted anywhere in the State.

Locust Borer

The locust borer continued to kill some black locust trees in Boise.

Spruce Bud Scale

Spruce bud scale infestations were detected on ornamental spruce scattered throughout southern Idaho.

California Tortoiseshell

Defoliation of ceanothus by the California tortoiseshell butterfly continued in several locations in northern Idaho. No formal surveys to determine severity of these infestations were conducted. However, the extent of infestations appeared to be less than in 1987.

Alder Flea Beetle

Extensive defoliation of alder by the alder flea beetle was observed between Coeur d'Alene and Sandpoint. Though infestation extent is not known, it may be fairly widespread since defoliation was noted in some areas of western Montana. Infestations of this type are usually short-lived.

Sequoia Pitch Moth

Insects that resembled Sequoia pitch moths were found killing tops of second-growth ponderosa pine in northern Idaho. Damage was found primarily in pure ponderosa pine stands where 1-4 feet of dead top appeared on 40- to 70-foot trees. Pitch masses were produced and girdling was evident under these masses. Secondary scolytid beetles were often found in the dead stem of affected trees.

DISEASES

ROOT DISEASES

Root diseases are the most serious disease problems in many forest stands, in northern Idaho. Common root diseases include Armillaria root disease, laminated root disease, annosus root disease, brown cubical root and butt rot, tomentosus root disease, and Leptographium root diseases. Two or more root pathogens may occur together on the same tree. Root disease is often associated with bark beetle attacks. Major hosts of root diseases in Idaho include Douglas-fir, grand fir, western hemlock, Engelmann spruce, and subalpine fir. Root diseases may also occur in young pine and larch stands and are especially important in hastening death of improperly planted trees. In heavily affected stands, volume may be reduced by 25-75 percent. Root disease associated mortality rates of about 4 percent/year may be common in Douglas-fir stands.

Armillaria root disease is probably the most widespread root disease in the State. In northern Idaho, pathogens are more often aggressive tree killers, whereas in southern Idaho, only stressed trees are

usually killed. Taxonomic research is continuing to gain insight into this complex of species. Recently, researchers have found that *Armillaria* is really a complex of fungi involving several different species or strains. At least nine distinct biological groups of *Armillaria* have been observed and additional work is proceeding to determine pathogenicity of these groups. Although several species of *Armillaria* may occur in the State, *A. ostoyae* is most commonly associated with root disease centers.

Laminated root disease occurs only in the northern part of Idaho and is especially damaging in Douglas-fir/grand fir stands on the Idaho Panhandle NFs. Two "strains" of the fungus associated with laminated root disease have been identified based on host specialization. These are the Douglas-fir and Western redcedar strains, both of which have been found in north Idaho.

Annosus root disease is believed to be widespread on Douglas-fir and grand fir within the Clearwater and Nez Perce NFs. This disease is often associated with Armillaria root disease and can be easily overlooked because of difficulties in diagnosis. The fungus causing this disease is divided into two intersterility "strains": the "S" group found on true fir, western redcedar, and Douglas-fir and the "P" group found on ponderosa pine. Both of these host-specific strains occur in Idaho.

Brown cubical root and butt rot is common in many older stands of Douglas-fir and ponderosa pine. The fungus rarely kills infected trees by itself. However, it often predisposes trees to bark beetle attack or infection by other more virulent root pathogens.

Tomentosus root disease is often found in roots of windthrown or uprooted Douglas-fir trees throughout central and southern Idaho. Another important host is subalpine fir, particularly in southwestern Idaho. This root disease may occasionally be associated with both armillaria and laminated root diseases in northern Idaho.

Leptographium root diseases are caused by several fungi in the genus *Leptographium*. Three strains of *Leptographium wageneri* (= *Verticicladiella wageneri*) exist. Primary hosts are ponderosa pine, pinyon pine, and Douglas-fir. This species causes "black stain root disease". Other decline type diseases of conifers in Idaho are sometimes associated with *Leptographium* species. All of these diseases are closely associated with bark beetles, either as vectors of the fungi or as attackers of diseased trees.

FOLIAGE DISEASES

Ponderosa Pine Foliage Diseases

There are several needle disease fungi which attack ponderosa pine, causing a variety of symptoms. Elytroderma needle cast is a perennial problem in ponderosa pine stands throughout the State. It is of concern only in localized areas. During the past few years, the pine stands around Little Donner Pass north of Cascade showed extensive damage.

"Greybeard" is a description of the drooping grey needles resulting from a needle disease. It has been a perennial problem on several localized areas, particularly in the southern part of the State.

Douglas-fir Foliage Diseases

The epidemic infection levels of Rhabdocline needle cast noted throughout southern Idaho in the fall of 1987 caused widespread reddening but only moderate defoliation of year-old foliage at the beginning of the 1988 growing season. The disease was less pronounced than expected, possibly because of an

earlier than normal spring flush of growth, and the likelihood that trees affected by three years of drought had reduced leader and foliage growth last year.

Swiss needle cast has spread throughout the Douglas-fir range in northern Idaho, but infection levels in 1988 appeared to be quite low.

These two foliage diseases are still a major limiting factor in Douglas-fir Christmas tree production, and research on resistance is currently underway.

Lodgepole Pine Needle Cast

Damage from lodgepole pine needle cast was very low in 1988. The warm, dry weather conditions during much of the growing season kept infection at a very low level.

Larch Foliage Diseases

Damage from larch needle cast and larch needle blight was low during 1988. The continued drought with its warm, dry conditions which prevailed during much of the growing season was probably responsible for low occurrences of these diseases.

Conifer Needle Rusts

Needle rusts caused by several different fungi occurred on most conifer species but were usually of merely incidental concern. However, on Christmas tree plantations near Sandpoint, very high levels of needle rust caused extensive damage to white fir trees. Damage was especially prominent in low lying areas
of plantations which had poor air drainage.

Miscellaneous Foliage Diseases

Fir broom rust occurs on subalpine and grand fir throughout the State. Recently, high infection levels were noted in forested areas south of Twin Falls and Burley.

Needle cast of grand and subalpine fir occurs in localized areas throughout the State. Infected stands were recently found on the Council and Weiser Ranger Districts, Payette NF.

Broom rust of Engelmann spruce is also scattered throughout the State. However, it was most common in stands of southeastern Idaho.

Marssonina blight of aspen was found at fairly light levels in stands in southern Idaho.

STEM AND BRANCH DISEASES

Dwarf Mistletoes

Dwarf mistletoes are important diseases in many conifer stands. Losses are particularly extensive in southern Idaho. The main effect of these parasites is growth loss. In addition, dwarf mistletoes may predispose trees to attack by insects and pathogenic fungi and otherwise reduce life expectancy of hosts.

Dwarf mistletoes can be adequately controlled by silvicultural treatments in stands managed for timber. Harvest cuts can reduce or eliminate infected trees from stands. Sanitation thinning of lightly infested stands will reduce losses. Residual tree removal will protect regeneration. Advances in identifying and removing dwarf mistletoe infected overwood and then successfully regenerating the sites have occurred in numerous areas of mountain pine beetle-killed lodgepole pine of the Targhee and Sawtooth NFs in southern Idaho. Accomplishments in different management categories for southern Idaho NFs are summarized in Table 4.

Table 4.--Dwarf mistletoe control accomplishments in southern Idaho, 1988.

National Forest	Presuppression survey acres	Suppression project acres	Post-suppression evaluation acres
Boise	51,020	500	670
Caribou	600	55	0
Challis	3,280	95	100
Payette	500	338	0
Salmon	0	258	0
Sawtooth	0	56	0
Targhee	28,188	1,066	16
Totals	83,588	2,368	786

White Pine Blister Rust

White pine blister rust is a very important disease in northern Idaho, limiting production of western white pine on many sites. The major approach to reducing losses from this disease involves production of disease-resistant nursery stock and outplanting such stock on sites where the disease is expected to occur. Pruning infected branches and excising cankers is used in selected precommercial stands that would otherwise undergo excessive mortality.

Miscellaneous Stem Cankers

Western gall rust is common throughout Idaho and is locally damaging ponderosa and lodgepole pine. This disease may cause mortality of young trees by causing girdling cankers; in older trees the disease may cause defects as enlarging, perennial cankers on main stems. This disease is most important as a cause of potential tree failures in areas of concentrated public use.

Atropellis canker is sometimes important in pole stands of lodgepole pine. Damage has especially been noteworthy in young pole and sawtimber stands adjacent to roads and other disturbed sites.

Comandra blister rust infections occur on lodgepole and ponderosa pine in different portions of the State. Highest levels of infection probably occur in southeastern Idaho.

Stalactiform blister rust occurs in localized areas of lodgepole pine across southern Idaho. Severe infection has been noted in several areas.

Dasyscypha canker has been reported on pole-sized Douglas-fir trees, particularly causing top kill. The disease usually occurs only on trees stressed by other agents.

Cytospora canker occurs sporadically on young grand fir in stands in northern Idaho. The disease results in branch flagging and top kill of infected trees. Several hardwood species are also affected by this disease, particularly in southern Idaho.

MISCELLANEOUS DISEASES

Dutch Elm Disease

The City of Boise has a street tree population of about 1,700 elm trees, which is down from more than 4,000 trees just a decade ago. In 1988, 31 trees died from Dutch elm disease; a total of 75 elms died of all causes. The long-range plan for the city is to replace elms with tree species not affected by the disease and requiring less maintenance.

Decays

Indian paint fungus is the major cause of defect in mature true fir and hemlock in overmature stands throughout the State.

Red ring rot is widespread in pines, larch, Douglas-fir and spruce in Idaho. However, damage varies widely throughout the State.

Aspen canker and trunk rot are common in many aspen stands throughout Idaho. Damage is most severe in older stands.

Weather Related Problems

The drought of 1986 continued through the summer of 1988. During the spring, a considerable amount of tree mortality was observed as a direct result of the prolonged drought. All species and all ages were affected, but mortality was most severe on Douglas-fir and western redcedar regeneration growing on droughty sites.

While this weather may have resulted in a decline of some diseases which require a lot of moisture, such as needle casts and blights, the lack of moisture greatly increased incidence of other pest problems which thrive on stressed trees. This trend is expected to result in higher bark beetle and root disease mortality in 1989.

NURSERY DISEASES

Fusarium Root Disease

Fusarium root disease is a common problem of conifer seedling production in Idaho. This disease is especially serious in container seedling operations. Losses are most severe on Douglas-fir, western larch, and Engelmann spruce. The disease is caused by *F. oxysporum* and several other *Fusarium* species, including *F. acuminatum*, *F. avenaceum*, *F. tricinctum*, and *F. sambucinum*. *Fusarium* inoculum is often introduced on infected seed or contaminated containers. Many seedlings may become infected but do not produce disease symptoms. Once disease symptoms appear, efforts to control the disease are largely unsuccessful.

Fusarium root disease was also found on bareroot stock at the USDA Forest Service Nursery in Coeur d'Alene. Greater than normal disease occurred on 1-0 Engelmann spruce seedlings. These seedlings had been sown in soil fumigated with Basamid®.

Fusarium was also associated with losses of transplant stock at the Coeur d'Alene Nursery. Transplants were either plug + 1 or 2-1 stock; greater losses occurred in container transplants.

Cylindrocarpon Root Disease

This disease occurs on containerized conifer seedlings at most nurseries in Idaho. These organisms are usually not as aggressive as *Fusarium* in causing disease and often infected seedlings lack disease symptoms. However, root decay may occur despite lack of above-ground symptoms and damage from these organisms may not be detected until seedlings are lifted. These fungi commonly inhabit conifer seedcoats and often persist on containers between seedling crops.

Grey Mold

Grey mold is a common problem of containerized conifer seedlings. Losses are most pronounced at the end of the crop cycle and particularly on western larch and Engelmann spruce. Severity of this disease varies depending on environmental conditions such as moisture, temperature, and light intensity. Damage is often found when seedlings are removed from the greenhouse and placed outside where weather conditions cannot be controlled. Control of this disease is most often attempted by applying chemical fungicides to foliage when symptoms appear. Infected seedlings can also be removed to reduce amounts of inoculum.

The fungus causing grey mold has recently been detected on several lots of conifer seed. It occurs as a contaminate of seed coats; infected seed may be an important source of inoculum by introducing the pathogen into container operations.

Meria Needle Cast

This disease occurs occasionally on bareroot western larch seedlings at the Coeur d'Alene Nursery. It usually causes problems during cool, wet weather, particularly during the spring of the second growing season. The disease has recently been effectively controlled by applications of fungicide during periods of potential infection.

Meria needle cast has also been important in tree improvement plantations such as early selection trials. The disease along with spring frost damage has seriously restricted seedling development, thus limiting effectiveness of several trials.

Sirococcus Tip Blight

This disease occurred at "normal" levels in several nurseries in northern Idaho. The disease causes mortality of containerized Engelmann spruce seedlings, particularly after seedlings are several months old. Inoculum for container seedlings is often seedborne.

Sirococcus tip blight also occurs sporadically on bareroot ponderosa, lodgepole, Austrian, and Scots pine seedlings. These seedlings are often not killed by the disease, rather the pathogen causes cankers at the tops of seedlings resulting in a top blight. Disease severity seems related to longevity of cool, wet weather during the growing season.

Diplodia Tip Blight

This disease occurs during most years at a bareroot nursery east of Lewiston. However, losses during 1988 were less than normal because of persistence of warm dry weather throughout most of the growing season. This disease can usually be adequately controlled by applying fungicides during the spring and early summer. Fungicide applications during the first growing season are especially important in reducing impact of this disease the following year.

Phoma Blight

This disease occurs on most crops of conifer seedlings in Idaho. Pathogens cause tip dieback on bareroot stock and mortality of young containerized seedlings. Inoculum is soilborne as well as often isolated from conifer seedcoats. Soil fumigation helps reduce disease incidence in bareroot operations and seed treatments are used to reduce problems of container seedlings.

Pythium Root Disease

This disease was particularly serious on transplanted container and bareroot seedlings at the Coeur d'Alene Nursery. Seedlings located in low, poorly drained seedbeds were especially damaged. Western white pine and Douglas-fir were mostly affected. The disease not only caused mortality; it was also responsible for reduced growth and chlorotic foliage.

PATHOLOGY PROGRAM SUMMARY

Root Diseases

Several projects have been initiated to gain additional information regarding root disease in a variety of stand situations. Status of these projects is summarized below.

1. Since ponderosa pine is generally less susceptible to most root diseases than Douglas-fir and true firs, managers were concerned about potential root disease losses in young plantations. Permanent plots and two types of random transects were established to monitor root disease mortality. Mortality so far has been confined to improperly planted trees, and both of the transect methods found ponderosa pine mortality rates of about 2-3 percent per year. Annual monitoring will be continued to determine if

the mortality rates taper off as expected. Additional ponderosa pine plantations may be sampled in 1989 to broaden this data base.

2. Root disease mortality in Douglas-fir and grand fir stands that have been precommercially thinned is being monitored. Although additional plots are needed, preliminary indications show that about 4 percent of the Douglas-fir and grand fir have been killed by root disease within the past 5 years, and many more trees are infected that do not show disease symptoms yet.

3. A 5-year study of more than 100 one-twentieth-acre plots in root disease centers within mature stands has shown that over 75 percent of the trees exhibiting symptoms died within 5 years. In addition, many trees with little or no symptoms started to show symptoms or died within this period. Originally, 35 to 50 percent of the Douglas-fir volume in the plots was concentrated on trees with no root disease symptoms. However, after 5 years this dropped to 10 to 35 percent and several plots had no healthy Douglas-fir trees left.

In terms of actual mortality, losses equivalent to volumes of 3,800 board feet per acre (2,700-4,500 range) occurred over the 5-year period. However, most plots had already lost about 25 percent of their Douglas-fir volume to root disease mortality (range 7 to 35 percent) prior to this study. Therefore, the total Douglas-fir volume loss on the plots averaged more than 55 percent (range 45 to 77 percent), and much of the remaining volume was in trees exhibiting root disease symptoms. It should be noted that these losses were associated with known root disease centers, so this level of loss cannot be attributed to the entire acreage.

4. A new project has been initiated to monitor effects of various nitrogen and potassium fertilizers on Armillaria root disease. Ten one-tenth-acre plots were established in a 35 year-old stand of primarily Douglas-fir which had been precommercially thinned several years before. This is a long-term project that should shed some light on effects of applying urea fertilizer following thinning.

5. Root disease-caused mortality over a broad range of stand conditions is being evaluated within several compartments on the Idaho Panhandle and Clearwater NFs. Permanent plots are remeasured on an annual basis to detect yearly fluctuation in mortality rates. Annual mortality rates have varied considerably amoung stands. The average rates for Douglas-fir and grand fir are 4.3 and 2.1 percent per year, respectively. These mortality rates are higher than those of other tree species and those due to all other causes.

The plots were established and are monitored by Forest Service district personnel with training and financial support from Pest Management in the Regional Office. These projects will be used to develop a root disease hazard rating system which will provide needed information for planning harvest activities. It will help to identify stands which are losing or soon will be losing the greatest volumes of timber. These stands can be scheduled for early harvest to avert much of the loss due to root disease mortality. Information from hazard ratings will also be used to assess root disease impact over large areas and adjust productivity projections for stands and compartments. Additionally, these projects include many stands which have been or are scheduled for commercial thinning. They will be monitored following thinning to evaluate the effects of thinning on mortality rates.

6. A project was completed on the Flathead Indian Reservation in western Montana that has implications elsewhere in the Region, including northern Idaho. This project was designed to evaluate stump infection in a ponderosa pine commerical thinning sale area by *Heterobasidion annosum*. This fungus is known to infect recently cut stumps from thinning, then spreads to kill residual crop trees. The thinning

was completed in March, 1988 and only 2 percent of the stumps were infected at that time. However, by September, the stump infection rate was 42 percent, indicating that stump infection taking place after thinning was extensive.

7. Root disease was evaluated as a possible predisposing factor in mountain pine beetle attacks in some lodgepole pine stands. Stands with endemic levels of mountain pine beetle populations were examined for correlations between root pathogen damage and beetle attacks. *Perenniporia subacida* was indicated as a predisposing factor for attack by beetles other than the mountain pine beetle; no mountain pine beetle was found in these stands. *Armillaria ostoyae* was associated with mountain pine beetle and other bark beetle attacks in small-diameter thinned stands in another area.

Dwarf Mistletoes

Chemical control of dwarf mistletoes has been a goal of pathology research for decades. Despite numerous efforts centered mostly on formulations of 2,4-D and 2,4,5-T, none of the chemicals tested have been effective in killing dwarf mistletoe plants without causing injury to host trees.

On September 1, 1987, EPA approved use of a growth-regulating chemical called Ethephon for use in reducing the spread of dwarf mistletoes. Ethephon causes shoot abscission without phytotoxic effects of trees, but does not affect the root-like (endophytic) system of the parasite that is embedded within host tissues. However, by removing seed-bearing shoots, seed production and dispersal and spread of the parasite is delayed 3 to 5 years from one application of the chemical. Combination of chemical and cultural treatments could benefit management of high-valued trees infected with dwarf misteltoes, such as those in or around plantations, recreation areas, administrative sites, and summer homes.

A cooperative project was conducted on the Boise NF during the summer of 1988 to test the efficacy of Ethephon on shoot abscission of western dwarf mistletoe (*Arceuthobium campylopodum*) on ponderosa pine. Thirty plants were sprayed with either a 2,500 ppm solution with 0.5 percent X-77 surfactant or with just water and surfactant. Applications were made in July and August. Results for the July application indicated 94 percent of all treated shoots had died and fallen off. August application resulted in an 84 percent mistletoe shoot abcission. Treated trees will be observed for several years to determine rate of shoot resprouting and seed production.

White Pine Blister Rust

1. Field performance with respect to white pine blister rust infection is being evaluated in plantations of rust-resistant white pine. Twenty-six stands were surveyed in the Northern Region. The plantations ranged from 1 to 20 years of age and had 107 to 386 surviving planted white pines per acre. Infection rates were generally very low in both F1 (Sandpoint Seed Orchard) and F2 (Moscow Aboretum) stock types, with some notable exceptions. While 19 of the 26 stands had infection rates of less than 10 percent, four stands which were 4 years old had about 25 percent lethal infection, and a 20 year-old stand was 70 percent lethally infected.

2. A pruning and excising project was partially completed by the Wallace RD (Idaho Panhandle NFs) to control white pine blister rust in western white pine plantations. The demands of the 1988 fire season prevented completion of the project this past year. However, the district plans to resume the job in 1989. Several stands on the Fernan and St. Maries RDs were also evaluated for potential blister rust control projects. Presuppression surveys were conducted. The survey data were used to determine biological and economic feasibility of treating stands by pruning or excising.

Decays

A model to predict impact of the Indian paint fungus in grand fir stands developed for the Blue Mountains of Oregon was field tested in 1988 and found to be applicable for use in grand fir stands in the Clearwater area. The model was found to reliably estimate stem decay in 40- to 90-year old stands. A publication giving details for use is currently being prepared.

Nursery Diseases

1. Several evaluations were conducted in order to formulate more effective control measures for Fusarium root disease of conifer seedlings. Treatments including different concentration of sodium hypochlorite (bleach) and water heated by microwaves were evaluated for western larch seed. The hot water treatments appeared to be more effective in reducing amounts of *Fusarium* on a seedlot with high pathogen levels.

2. An evaluation was conducted at several nurseries in northern Idaho to test the efficacy of a granulated formulation of Banrot® in controlling Fusarium root disease. The fungicide was incorporated into growing media prior to sowing; disease and seedling development were monitored throughout the growing season. Treatments apparently did not affect disease occurrence or seedling infection. However, treated seedlings were consistently smaller than untreated seedlings. Therefore, it appears that this approach to controlling Fusarium root disease holds little promise.

3. Several evaluations have indicated that contaminated containers (styroblock and pine cell) may be important sources of *Fusarium* inoculum. These evaluations have also indicated that standard steam-cleaning treatments do not adequately reduce this contamination. In one evaluation, fumigation with methyl bromide was also unsatisfactory. Because of the importance of reducing this inoculum source to acceptable levels, evaluations of other potential "cleaning" techniques are planned. One of the methods to be tested is use of sodium metabisulfite to clean containers. This chemical has shown promise in several nurseries in British Columbia and, if effective, may provide growers with an important alternative to standard techniques.

4. An evaluation of the fate of *Fusarium* on outplanted containerized seedlings is in its second year. After two growing seasons, the fungus was still detected on the roots of some seedlings, but was limited to the old "plug" roots and had not colonized newly egressed roots. *Fusarium* was not responsible for any seedling mortality.

5. For the past 2 years, evaluations have been conducted at the Coeur d'Alene Nursery to determine efficacy of Basamid® fumigation to control bareroot seedling root diseases. This chemical has reduced soil populations of *Fusarium* and *Pythium* but not to the levels possible with fumigation with methyl bromide. Satisfactory disease control has occurred in areas treated with Basamid®; however, pathogen populations have been very low and may increase over time. Repeated soil fumigation with methyl bromide/chloropicrin has greatly reduced background pathogen populations at the nursery. Hopefully, these organisms will not greatly increase after methyl bromide is replaced with Basamid®. Continued monitoring of soil pathogen populations will be necessary to adequately evaluate effectiveness of this new fumigant.

6. Methods were tested to improve the inoculation success and reliability of the blister rust resistance screening project of the white pine tree improvement program. The USDA Forest Service Nursery in Coeur d'Alene and Pest Management tested several methods for growing, inoculating, incubating and

6. Methods were tested to improve the inoculation success and reliability of the blister rust resistance screening project of the white pine tree improvement program. The USDA Forest Service Nursery in Coeur d'Alene and Pest Management tested several methods for growing, inoculating, incubating and storing seedlings for improved resistance screening. Results will be evaluated during the spring and summer of 1989.

7. Managers at the USDA Forest Service Lucky Peak Nursery near Boise have also been field testing alternative fumigants to replace methyl bromide/chloropicrin. In 1987 and 1988 the populations of three genera of potential conifer seedling root pathogens, *Fusarium*, *Pythium*, *Phytophthora*, and *Rhizoctonia* were monitored prior to and following fumigation with a granular application of Basamid®. Wide variances in fungal population levels were noted between fields, attributed mostly to differences in soil structure and cropping history. While post-fumigation levels of all three fungi were sufficiently reduced initially, *Fusarium* spp. populations resurged to levels comparable to control plots within 2 months. Nevertheless, seedling mortality rates were similar to previous fumigation techniques, so the post-fumigation *Fusarium* increase may be part of the normal microfloral background that infest soil by means of rain, wind, or irrigation water.

APPENDIX

DIRECTORY OF PERSONNEL

Idaho Department of Lands
Bureau of Private Forestry
P. O. Box 670
Coeur d'Alene, ID 83814 Phone: 208/664-2171

William E. Love	Bureau Chief
R. Ladd Livingston	Section Supervisor, Entomologist
John W. Schwandt	Forest Pathologist
David P. Beckman	Technician, I&D Section

USDA Forest Service, Northern Region (R-1)
Timber, Cooperative Forestry and Pest Management
Federal Building
P. O. Box 7669 Phone: 406/329-3280
Missoula, MT 59807 FTS: 8-585-3280

John H. Thompson	Assistant Director
Robert G. Eder	Computer Programer/Analyst
James W. Byler	Pathology Group Leader
Susan K. Hagle	Forest Pathologist
Carma J. Gilligan	Biological (Laboratory) Technician
Lionel Hall	Biological Technician
Jerald E. Dewey	Entomology Group Leader
Kenneth E. Gibson	Forest Entomologist
Larry E. Stipe	Forest Entomologist
Sandra Gast	Forest Entomologist
Sara J. Zimmer	Forest Entomologist
William Antrobius	Forest Entomologist
Robert D. Oakes	Biological Technician
Hubert E. Meyer	Biological Technician

USDA Forest Service, Northern Region (R-1)
Timber, Cooperative Forestry and Pest Management
1201 Ironwood Drive
Coeur d'Alene, ID 83814 Phone: 208/765-7421

Robert L. James	Plant Pathologist

USDA Forest Service, Intermountain Region (R-4)
Forest Pest Management
Federal Building
324 25th Street
Odgen, UT 84401

Phone: 801/625-5257
FTS: 8-586-5257

David G. Holland	Group Leader
Leon Lamadilaine	Plant Pathologist/Ogden Field Representative
A. Steven Munson	Entomologist
Robert L. Mathiasen	Forest Pathologist
Valerie L. Kalve	Biological Technician

USDA Forest Service, Intermountain Region (R-4)
Forest Pest Management
Boise Field Office
1750 Front Street
Boise, ID 83702

Phone: 208/334-1345
FTS: 8-554-1345

Ralph E. Williams	Field Representative
James T. Hoffman	Forest Pathologist
R. W. Thier	Forest Entomologist
Julie C. Weatherby	Forest Entomologist
K. Andrew Knapp	Biological Technician
Philip J. Mocettini, Jr.	Biological Technician
Joy C. Roberts	Computer Programmer/Analyst

INDEX OF INSECTS AND DISEASES

Insects

Common Name	Scientific Name
Alder flea beetle	*Altica ambiens* LeConte
Balsam wooley adelgid	*Adelges picea* (Ratzburg)
California tortoiseshell	*Nymphalis californica* (Boisduval)
Cone moth	*Eucosma recissoriana* Heinrich.
Cone worms	*Dioryctria* sp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* Mc Dunnough
Forest tent caterpillar	*Malacosoma disstria* Hubner
Fir engraver	*Scolytus ventralis* LeConte
Gouty pitch midge	*Cecidomyis piniopsis* O. S.
Gypsy moth	*Lymantria dispar* (L.)
Hemlock sawfly	*Neodiprion tsugae* Middleton
Larch casebearer	*Coleophora laricella* (Hub.)
Locust borer	*Megacyllene robiniae* (Foster)
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine butterfly	*Neophasia menapia* (Felder & Felder)
Pine engraver	*Ips pini* (Say)
Pine needle sheathminer	*Zelleria haimbachi* Busck.
Sequoia pitch moth	*Vespamima sequoiae* (H. EdwaRD's)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Spruce bud scale	*Physokermes piceae* (Schrank)
Sugar pine tortrix	*Choristoneura lambertiana* (Busck.)
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

Diseases

Annosus root disease	*Heterobasidion annosum* (Fr.)Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.)Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.)Pat.
Comandra rust	*Cronartium comandrae* Peck.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.)Dyko
Dothistroma needle blight	*Scirrhia pini* Funk & Park.
Dutch elm disease	*Ceratocystis ulmi* (Buism.)C. Mor.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needle cast	*Elytroderma deformans* (Weir)Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Needle rust	*Pucciniastrum* spp.; *Lirula* spp.
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.) Ell. & Ev.
Laminated root rot	*Phellinus weirii* (Murr.)Gilb.
Leptographium root diseases	*Leptographium* spp.
Lodgepole pine needle cast	*Lophodermella concolor* (Dearn.)Dark.
Meria needle cast	*Meria laricis* Vuill.
Phoma blight	*Phoma* spp.
Red band needle blight	*Scirrhia pini* (Funk & Park.)
Red ring rot	*Phellinus pini* Pilat.
Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd.
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Swiss needle cast	*Phaeocryptopus gaumanni* (Rhode)Pet.
Tomentosus root disease	*Inonotus tomentosus* (Fr.)Gilb.
Western gall rust	*Endocronartium harknessii* (Moore)Hir
White pine blister rust	*Cronartium ribicola* Fisch.

RECENT PUBLICATIONS

Arnold, J. A. 1988. Evaluation of preventive treatment for mountain pine beetle in high-value stands of lodgepole pine. USDA Forest Service, Intermountain Region. Rept. 88-3. 8p.

Arnold, J. A. 1988. Western spruce budworm egg mass survey, Beaver Mountain, Logan RD, Wasatch-Cache National Forest. USDA Forest Service, Intermountain Region. Rept. 88-2. 5p.

Dewey, J. E., L. Livingston, S. Kohler, and C. Sartwell. 1988. Control of western pine shoot borer, *Eucosma sonamana* Kearfott, in selected ponderosa pine plantations in northern Idaho and western Montana. USDA Forest Service, Northern Region. Rept. 88-13. 9p.

Dumroese, R. K., R. L. James, D. L. Wenny, and C. J. Gilligan. 1988. Douglas-fir seed treatments: effects on seed germination and seedborne organisms. *In*: Landis, T. D. (tech. coord.). Proceedings: Combined Meeting of the Western Forest Nursery Associations. USDA Forest Service, Gen. Tech. Rept. RM-167. pp. 155-160.

Forest Pest Management. 1988. Biological evaluation of a mountain ine beetle infestation on the Sawtooth National Recreation Area, Idaho - 1987. USDA Forest Service, Intermountain Region. Rept. 88-4. 9p.

Gibson, K. E. 1988. Partial cutting of lodgepole pine stands to reduce tree losses to mountain pine beetle. Northwest Environmental Journal 4(2):337-338.

Gibson, K. E. and R. D. Oakes. 1988. Bark beetle conditions, 1987. USDA Forest Service, Northern Region. Rept. 88-4. 39p.

Hoffman, J. T. 1988. Dwarf mistletoe suppression program in Region 4:1977-1992. USDA Forest Service, Intermountain Region Rept. 88-5. 7p.

Hoffman, J. T. and R. E. Williams. 1988. Evaluation of spring-applied Basamid to control soil-borne root pathogens at Lucky Peak Nursery, Idaho. USDA Forest Service, Intermountain Region. Rept. 88-11. 7p.

James, R. L. 1988. Principles of fungicide usage in container tree seedling nurseries. Tree Planters' Notes 39(2):22-25.

James, R. L. 1988. Root disease of containerized conifer seedlings - Western Forest Systems Nursery, Lewiston, Idaho. USDA Forest Service, Northern Region. Rept. 88-3. 5p.

James, R. L, R. K. Dumroese and D. L. Wenny. 1988. *Fusarium* diseases of containerized conifer seedlings in northern Rocky Mountain nurseries: Infection, symptom production and pathogenicity of associated fusaria. Phytopathology 78(12):1533.

James, R. L., R. K. Dumroese and D. L. Wenny. 1988. *Fusarium* diseases of containerized conifer seedlings in northern Rocky Mountain nurseries: Sources of inoculum and control tests. Phytopathology 78(12):1607.

James, R. L., R. K. Dumroese and D. L. Wenny. 1988. Occurrence and persistence of *Fusarium* within styroblock and Ray Leach containers. *In*: Landis, T. D. (tech. coord.). Proceedings: Combined Meeting of the Western Forest Nursery Associations. USDA Forest Service, Gen. Tech. Rept. RM-167. pp. 145-148.

James, R. L. and C. J. Gilligan. 1988. Association of *Fusarium* with non-diseased containerized ponderosa pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Rept. 88-5. 10p.

James, R. L. and C. J. Gilligan. 1988. Fungal colonization of styroblock containers - Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region. Rept. 88-10. 9p.

James, R. L. and C. J. Gilligan. 1988. Occurrence of *Fusarium* on Leach pine cells from the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Rept. 88-8. 10p.

James, R. L. and C. J. Gilligan. 1988. Occurrence of *Fusarium* on the roots of nondiseased bareroot Douglas-fir seedlings - USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Rept. 88-12. 4p.

James, R. L., C. J. Gilligan, R. K. Dumroese and D. L. Wenny. 1988. Microwave treatments to eradicate seedborne fungi on Douglas-fir seed. USDA Forest Service, Northern Region. Rept. 88-7. 8p.

James, R. L., C. J. Gilligan and V. Reedy. 1988. Evaluation of root diseases of containerized conifer seedlings at the Champion Timberland Nursery, Plains, Montana. USDA Forest Service, Northern Region. Rept. 88-11. 21p.

Keysor, A. M. 1988. Post-control evaluation of dwarf mistletoe, Kelly Guard Station Area, Kemmerer Ranger District, Bridger-Teton National Forest. USDA Forest Service, Intermountain Region. Rept. 88-7. 4p.

Knapp, K. A. 1988. The 1987 western spruce budworm conditions in the Intermountain Region. USDA Forest Service, Intermountain Region. Rept. 88-10. 19p.

Livingston, R. L. 1988. Pest evaluation and management recommendations for the mountain pine beetle on Pearl Island, Pend O'Reille Lake. Idaho Dept. of Lands Rept. 88-6. 5p.

Schwandt, J. W. 1988. Root disease evaluation in the Sturgeon Flats ponderosa pine plantation. Idaho Dept. of Lands Rept. 88-2. 4p.

Schwandt, J. W. and R. L. Livingston. 1988. Pest evaluation of Outlet Mountain timber sale. Idaho Dept. of Lands Rept. 88-3. 5p.

Tkacz, B. M. 1988. Evaluation of two soil fumigants at the Lone Peak State Nursery. USDA Forest Service, Intermountain Region. Rept. 88-6. 9p.

Weatherby, J. C. 1988. Douglas-fir tussock moth monitoring in southern Idaho, 1987. USDA Forest Service, Intermountain Region. Rept. 88-1. 7p.

3421